

Energy loss effects on charm and bottom production in high-energy heavy-ion collisions *

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In the early stage of relativistic heavy-ion collisions at RHIC energies and above, a dense parton system is expected to be formed. Interactions among the produced partons in this dense medium will most likely lead to partial thermalization and formation of a quark-gluon plasma.

It is important to study phenomenological signals of such interactions[1]. We have studied the effect of energy loss on charm and bottom quarks in high-energy heavy-ion collisions, including the effects of longitudinal expansion and partial thermalization. We find that high p_\perp heavy quarks are greatly suppressed and consequently, high-mass dileptons from heavy quark decays are also suppressed. We then consider the detector geometry and single lepton energy cuts of the PHENIX detector at RHIC. An energy loss rate on the order of 1 GeV/fm results in a large suppression of dielectrons. Thus dielectrons from heavy quark decays become comparable to or even lower than the Drell-Yan yield. This certainly provides a better opportunity to observe possible thermal dileptons from the quark-gluon plasma.

The energy loss effect also causes an unpleasant complication. The PHENIX Collaboration has proposed that the open charm cross section can be determined from $e\mu$ coincidence measurement so that the open charm dielectron and dimuon yields can be extrapolated from a consideration of the different rapidity coverages alone. However, energy loss complicates the acceptances for the three dilepton channels from heavy quark decays, making the proposed extrapolation difficult. Indeed at high invariant mass, the $e\mu$ yield may very well be dominated by bottom decays instead of charm decays. In this case, $e\mu$ coincidence at PHENIX can no

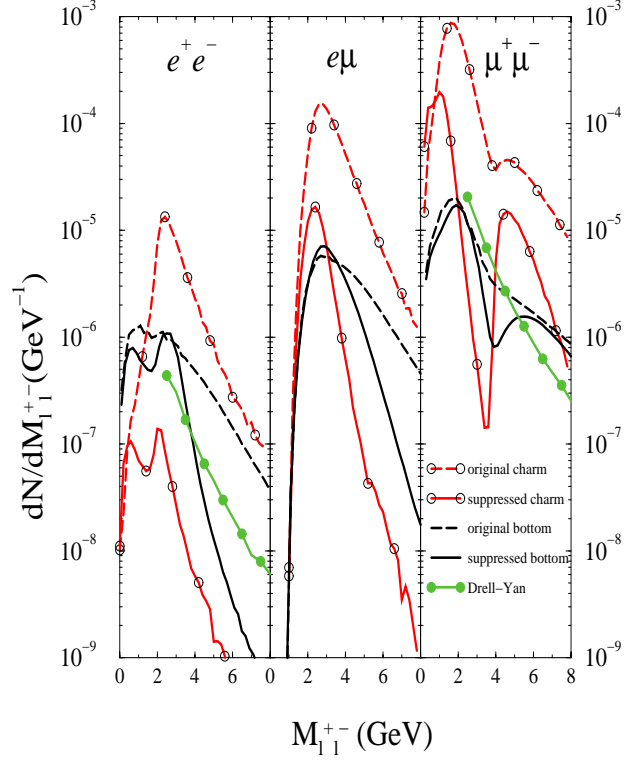


Figure 1: Dileptons from charm and bottom decays within the PHENIX acceptance assuming $dE/dx = -2$ GeV/fm.

longer measure the charm contribution but could be used for a bottom measurement. Dimuons above 4 GeV, which are well above the Drell-Yan yield even with a large energy loss rate, can be used for charm observation. Within the PHENIX acceptance, dielectrons are the most sensitive to the energy loss. Therefore, they are the best observables to study the energy loss if the heavy quark spectrum cannot be measured directly via traditional tracking techniques.

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[1] E. Shuryak, Phys. Rev. C 55 (1997) 961.